RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

B.A./B.Sc. SIXTH SEMESTER EXAMINATION, MAY 2017

THIRD YEAR [BATCH 2014-17]

Date : 02/05/2017 **MICROBIOLOGY (Honours)**

Time : 11 am – 1 pm **Paper :** VII (Gr. A) Full Marks : 50

Answer <u>any five</u> questions : [5×10]

1. a) State the functions of the enzymes concerned with the homologous recombination- Rec A, Rec B, Rec C, ssb protein, Rec D and Ruv C. 3
   b) What will happen to *E. coli*, if the *dam* gene of its genome is mutated? 3
   c) How can you prove the nature of transition mutation – $AT \rightarrow GC$ or $GC \rightarrow AT$? 2
   d) "QTL mapping plays a seminal role to identify the links between different traits expressed in an evolutionary trend" – Justify. 2

2. a) How did Watson-Crick explain the causes of spontaneous mutation during the presentation of a double helical model for DNA? 3
   b) What are meant by dominant gain-of-function and recessive loss-of-function in relation to cancer development? 2
   c) How does *uvr* system in *E. coli* repair any bulk lesion in DNA? 4
   d) Define "Bootstrap Method". 1

3. a) What are the major types of DNA damage repaired by each of the following pathway: 4
      i) Photoreversal
      ii) Base excision repair
      iii) Nucleotide excision repair
      iv) Mismatch repair

   b) Which of the above mentioned pathway is associated with the following enzymes: 4
      i) Uracil DNA glycosylase
      ii) DNA ligase
      iii) DNA polymerase
      iv) DNA photolyase
   c) Name two human diseases caused by defects in DNA repair system. 2

4. a) *E. coli* strain B is killed by phage T4. A Luria-Delbruck fluctuation test was done to determine the rate of mutation to resistance to phage T4. The following result was obtained:
      Number of tubes with no $T4^R$ mutation = $^{8}/_{20}$ total.
      Average number of cells per cutture = 5.6×10^{8}. What is the mutation rate? 3
   b) How was it proved that a staggered cut is formed during transposition? 2
   c) To find out the evolutionary status, why the 'Molecular Data' on an organism is considered more reliable than that of its morphological details? 4
   d) Name major molecular agents of the organic evolution. 1

5 a) The base sequence of a wild type mRNA is $5'\cdots AUGUACUAA\cdots 3'$. One of it mutant mRNA exhibited the base sequence $5'\cdots AUGUAGUAA\cdots 3'$, UAC codon has been changed to nonsense UAG codon. State the mechanism by which the mutant can be reverted to wild type phenotype. 3

b) To obtain a substrate transition mutation using 5-BU, the mutagen should be present in the culture medium. Why? 3

c) Discuss the user protocol for homology searching by using BLAST. 2

d) Find out the score from the following alignment by considering affine penalty = –1, Match = +1, Mismatch = –1, Gap = –2. 2

C C T G G G C T A T G C
C C – G G T T – T G C –

6. a) In Ames test, the *his* mutants used by Bruce Ames possessed several unique features required for testing the mutagenicity of chemicals. State the features of *his* mutants. 3

b) You want to change a particular amino acid of a polypeptide. Show schematically how will you proceed. 4

c) Write down the features of FASTA. 1½

d) Explain the different data processing algorithm in bioinformatics. 1½

7. a) What is proto-oncogene? Name two proto-oncogenes that may be converted to oncogenes to give rise cancers. 2+½+½

b) You infected mice with mammary tumor virus. After a period of time, most infected mice have developed breast cancer, whereas uninfected mice did not. You cultured the tumor cells and find that viral DNA is integrated into the host chromosome. Do you think all the viral DNA integrate in the same chromosomal location? Justify your answer. 2

c) How does tumor suppressor gene work? Explain with an example. 2½

d) What is homobox? Where do you find it? Name one transcriptional activator that recognise homobox. 1½+½+½

8. a) In chronic myelogenous leukemia (CML), the karyotype is characterized by a small chromosome named Philadelphia chromosome. How does it arise and what is its effect on gene functioning? 3

b) What is visceral leishmaniasis? 3

c) What is super infection? Give an example. 2

d) Distinguish between scaled and unscaled trees used in molecular phylogenetics. 2

9. a) In one population samples, the following blood type frequencies are observed: A = 0.53, B = 0.13, O = 0.26 and AB = 0.08. What are the frequencies of I^A, I^B and I^o alleles? 5

b) What are the symptoms of candidiasis? 2

c) What do you mean by XDR TB? 3

10. a) Describe the mechanism of action of:
i) Tetanus toxin
ii) Cholera toxin 2+2

b) What are the tri-drugs used to control AIDS? What is its mode of action? 1+2

c) What is the difference between somatic and germ line gene therapy? 2

d) Name one drug that block bacterial DNA synthesis. 1

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